Granular Fluctuation and Dissipation

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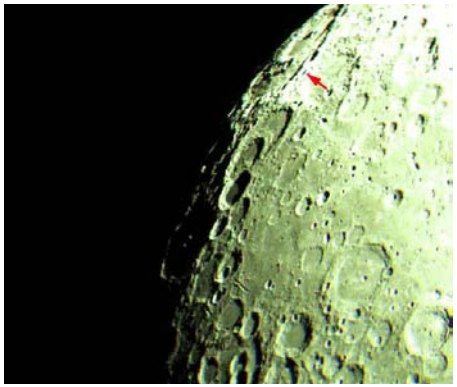
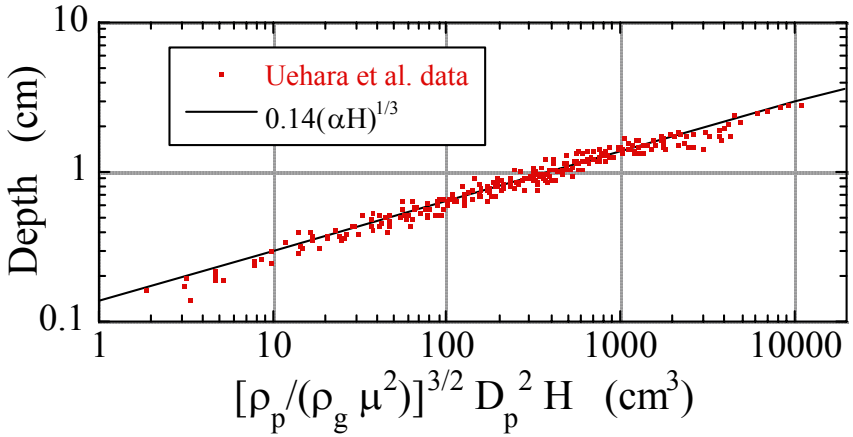
Modern society relies on handling granular materials, ranging from foods to building supplies to pharmaceuticals and more. Yet actual equipment is surprisingly prone to sudden failure, like clogging or jamming or demixing. Ultimately, this is because we still can't predict how the materials flow in response to applied forces.

One of our experiments is to probe granular mechanics in terms of the stopping force generated during the impact of a projectile. This can be deduced simply from the depth of penetration vs the projectile energy. Based on data for many different types and sizes of projectile, we have uncovered a new scaling law as demonstrated in the figure. It cannot be explained by current understanding of granular mechanics, and so represents an important challenge to theory. It may also lead to better understanding of impact phenomena, including geophysical cratering on a much larger scale. [Phys. Rev. Lett. **90**, 194301 (2003)]





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Education and Outreach:
Our original impact crater work was performed as the undergraduate thesis project of Ms. Jun Uehara, with assistance by graduate student Mr. Rajesh Ojha. Both have graduated and are now employed. The role of projectile shape was explored this summer by another undergraduate student, Ms. Katie Newhall. Jun and Katie were first author on respective peer-reviewed publications. Currently two undergraduate students (Mike Ambroso, Aaron Streets) and two graduate students (Adam Abate, Steve Suh) are conducting experiments on granular mechanics.

Jun Uehara

Rajesh Ojha